

## NATURAL RESOURCES CONSERVATION SERVICE

### CONSERVATION PRACTICE STANDARD

## DEEP TILLAGE

(Acres)

CODE 324

### DEFINITION

Performing tillage operations below the normal tillage depth to modify the physical or chemical properties of a soil.

### PURPOSES

This practice may be applied as part of a conservation management system to support one or more of the following:

- Fracture restrictive soil layers.
- Bury or mix soil deposits from wind or water erosion or flood overwash.
- Reduce concentration of soil contaminants, which inhibit plant growth.

### CONDITIONS WHERE PRACTICE APPLIES

This practice applies to land having adverse soil conditions which inhibit plant growth, such as compacted layers formed by field operations, restrictive layers such as claypans, overwash or deposits from wind and water erosion or flooding, or contaminants in the root zone.

This standard includes tillage operations commonly referred to as deep plowing, subsoiling, ripping, or row-till, performed from time to time below the normal tillage depth.

### CRITERIA

#### General Criteria Applicable to All Purposes

Deep tillage operations shall be performed when soil moisture is less than 30 percent of field capacity, according to the "feel test" or

other acceptable method, at the maximum depth to which the tillage will be done for best shattering effects. Estimating Soil Moisture by Feel and Appearance – Program Aid No. 1619 can be used as guidance for determining soil moisture.

If soil erosion is a potential problem as a result of this practice, other practices should be planned and used in conjunction with a complete conservation management system.

Deep tillage operations applied on terraced land will be done on the contour and in such a way that terraces are not damaged and remain fully functional for their intended purpose.

Underground utilities should be checked for depth and location prior to deep tillage.

#### Additional Criteria to Fracture Restrictive Soil Layers

Tillage equipment such as chisels, subsoilers, paraplows, bent-leg subsoilers, or rippers, with the ability to reach the required depth shall be used.

The depth of tillage shall be a minimum of one inch deeper than the depth of the restrictive layer. Tillage depth should be set carefully and periodically checked to maintain this working depth.

Complete fracturing of the restrictive layer is not required. The fractured zone, as a minimum, shall be sufficient to permit root penetration below the restrictive soil layer. The fractured zone does not need to extend to the row middles and should be limited to the area near the rows [in the case of crops broadcast-planted, drilled in narrow rows, (less than 15 inches) or grasslands, the fractured zone may

be disrupted completely].

**Average minimum bulk densities that restrict root penetration in soils of various textures**

Texture	Bulk Density g/cc
Coarse, medium, and fine sand	1.80
Loamy sand and sandy loam	1.75
Loam and sandy clay loam	1.70
Clay loam	1.65
Sandy clay	1.60
Silt and silt loam	1.55
Silty clay loam	1.50
Clay	1.40

**Additional Criteria to Bury or Mix Soil Deposits from Wind and Water Erosion or Flood Overwash**

Tillage equipment such as moldboard plows, disk plows or chisels with twisted points, with the ability to reach the required depth shall be used.

The tillage operation shall uniformly mix soil 6" or 2 times (2 X) the depth of overwash, whichever is deeper, to achieve a desired available water-holding capacity (AWC) and to break the hydrologic barrier caused by overwash layer.

Generally, no more than about 6 inches of overwash can be uniformly mixed into the soil profile using commonly available equipment. Specialized equipment may be necessary where greater depths of overwash are to be incorporated.

**Additional Criteria to Reduce Concentration of Soil Contaminants Which Inhibit Plant Growth**

Tillage equipment such as moldboard plows, disk plows or chisels with twisted points, with the ability to reach the required depth shall be used.

The tillage operation shall mix a sufficient amount of uncontaminated soil with the contaminated material so that the concentration of the contaminant is below the crop tolerance level. Crop tolerance levels shall be established in accordance with Oklahoma State University guidance and recommendations.

The soil contaminant shall be uniformly distributed throughout the deep tilled layer.

**CONSIDERATIONS**

Where restrictive layers are a concern, the effects of this practice can be enhanced by including deep rooted crops in the rotation that are able to extend to and penetrate the restrictive layer.

Avoid making tillage operations when the soil is wet. Water in the soil acts like a lubricant, so soil particles are easily rearranged and jammed together tightly decreasing pore space in the soil and increasing bulk density. A good rule of thumb is that soil squeezed in your hand then tossed about should fall apart. If not, it is too wet.

When possible harvest operations should be avoided when soil moisture is greater than 50 percent of field capacity. Field harvest haul traffic should be limited to end rows or haul roads. Compacted regions between crop rows that are not fractured can assist in supporting vehicle traffic, limiting rutting and soil compaction beneath the row.

Reduce the number of tillage trips across the field. Try to combine as many tillage trips as possible or settle for a less perfect seedbed. Most of the new drills and planters operate well under minimum tillage conditions.

Vary the depth of tillage from year to year and restrict the use of disc plows. Use chisels more than plows to do primary tillage. Sometimes chisels may require more energy to pull but leave residues on the soil surface. They also shatter and loosen the soil better.

Research on numerous crops has shown that tillage conducted excessively deeper than the compacted layer does not promote increased yields, requires excessive amounts of tillage energy, and promotes future compaction from nearby vehicle traffic.

Reduce or control equipment traffic during periods when soils are prone to compaction and formation of tillage pans.

When infertile flood overwash is mixed with the pre-flood soil profile, the soil rebuilding process can be enhanced by additions of organic matter, such as manure or cover crops utilized

as green manure. Crop rotations, tillage and planting systems, which maintain high levels of crop residues, such as no-till, can also accelerate this process.

Where the flood overwash layer is too thick to effectively mix with the pre-flood soil profile, redistribution of the overwash layer by smoothing or removal may be necessary.

Where unfavorable soil materials such as high sodium, calcium, gypsum or other undesirable materials, are within anticipated deep tillage depth and would be brought to the surface by deep tillage operations, this practice should not be applied.

Transport of sediment-borne pollutant(s) offsite can be reduced when this practice is used in a conservation management system, by reducing the concentration of pollutants in the surface layer.

If application of this practice will impact cultural resources (Archaeological, historic, historic landscape, or traditional cultural properties), follow NRCS national policy and State operating procedures for considering cultural resources.

## **PLANS AND SPECIFICATIONS**

Specifications for establishment and operation of this practice shall be prepared for each field or treatment unit according to the Criteria, Considerations and Operations & Maintenance described in this standard.

## **OPERATION AND MAINTENANCE**

Deep tillage for reduction of soil compaction shall be performed whenever compaction reoccurs.

When deep tillage has been performed to reduce the concentration of soil contaminants, the contaminate levels in the root zone shall be monitored to assist with determining when or if treatment will be reapplied.

**Reference – Oklahoma State University  
Extension Factsheet F-2244**